Original Article

Association between perioperative hypertension and haematoma formation in neck dissection for head and neck cancer

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Background: Neck dissection is a well-established technique for the oncological removal of involved or high-risk regional neck lymph nodes. Haematoma is a recognised complication that affects approximately 5% of patients following neck dissection. It is common for patients to develop hypertension following surgery. The aim of our study is to investigate whether those patients who experienced post-operative hypertension had a greater risk of haematoma formation.

Methods: This study was a retrospective cohort study of all patients undergoing neck dissection at Chris O'Brien Lifehouse, Sydney, Australia from August 2021 to April 2022. This study was approved by the Sydney Local Health District Human Research Ethics Committee (2019/ETH07164). Our primary outcome was haematoma formation in those with post-operative hypertension [defined as a systolic blood pressure (SBP) of greater than 180 mmHg at any time, the American Heart Association (AHA) definition of a hypertensive crisis] compared to those without. Our secondary outcome was the risk of haematoma formation in those with pre-existing hypertension. Risk ratios and Fisher's exact test were used to calculate significance.

Results: One hundred and twenty-seven patients underwent neck dissection at our institution in the study period. The average age was 64.9 years and 72.4% were male. A proportion of 51.2% of patients had pre-existing hypertension. Eight out of 127 (6.3%) patients had a haematoma requiring evacuation in theatre. The relative risk of haematoma formation in patients with post-operative hypertension was 0.92 which was non-significant [95% confidence interval (CI): 0.12 to 7.05, P=0.985]. The relative risk of haematoma formation was 6.67 (95% CI: 0.85 to 52.71, P=0.0397) in those with known pre-operative hypertension. However, due to the small sample size of our study and resulting wide confidence intervals, these results should be interpreted with caution.

Conclusions: Our study did not find a significant difference in the incidence of haematoma formation between those patients with post-operative hypertension and those without. The rate of haematoma was similar to that published in the literature at 6.3%. Our study also demonstrates that pre-existing hypertension is a risk factor for haematoma formation, in concordance with most of the other studies published in this area.

Keywords: Hypertension; neck haematoma; neck dissection; cancer

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Introduction

The use of neck dissection in head and neck cancer

Neck dissection is the surgical removal of lymph nodes, with or without other non-lymphatic structures, from the neck. This may be performed either simultaneously, as a staged procedure or a salvage procedure after surgical excision of malignancies from the head or neck. The lymph nodes of the neck are subdivided into six levels. Neck dissections are described by which levels of lymph nodes are resected and which non-lymphatic structures are preserved or resected.

Incidence of haematoma formation following neck dissection

There is considerable variation in the literature on the rate of post-operative haematoma following neck dissection. Only one study has looked specifically at haematoma following neck dissection for epithelial head and neck cancers (1). Utilising data from the National Inpatient Sample (discharge data from approximately 20% of United States hospitals between 2000 and 2009) revealed a 5.0% (145/2,876) rate of haematoma following neck dissection. Most other literature relates to neck dissection performed in conjunction with thyroidectomy. In this group, two meta-analyses have shown a haematoma incidence of 2.4% following thyroidectomy and neck dissection (2,3). Cohort and case-control studies have shown a variable incidence from 0.29% to 16.1% (4-10).

Postoperative haematoma can cause damage to surrounding structures including neural damage, oedema, compressive effects on the airway and threaten the viability of grafted flaps requiring operative intervention.

Risk factors for haematoma formation

A pre-operative diagnosis of hypertension has consistently been identified as a significant risk factor for the development of haematoma following thyroidectomy (2,3,10-13). Other risk factors identified were male sex, older age, concurrent neck dissection, the use of antithrombotic medications, operation length and previous neck surgery.

Post-operative hypertension

Post-operative hypertension is a well-recognised complication of lateral neck dissection. Case series demonstrate and incidence of between 10.6% and 23% with significant heterogeneity in the definition of post-operative hypertension. Studies used both absolute and relative cut-offs in the definition of post-operative hypertension, i.e., a blood pressure greater than 140/90 mmHg (14,15) or greater than 200/100 mmHg or of more than 40 mmHg systolic and more than 20 mmHg diastolic above preoperative levels (16).

Within the thyroidectomy literature, it has been demonstrated that post-operative hypertension is a risk factor for the development of haematomas requiring evacuation. Using a definition of post-operative hypertension as systolic blood pressure (SBP) >150 mmHg in the first 24 hours post-operatively, Morton *et al.* (17) and Samona *et al.* (18) found hypertension was a significant predictor of haematoma formation. A follow-up study by Morton demonstrated a 39% increase in risk of bleeding for every 10 points rise of highest blood pressure (19). However, these studies encompassed all thyroidectomies and did not report whether neck dissection was performed concurrently.

To date, no studies have examined whether there is an association between post-operative hypertension and haematoma formation after neck dissection. This paper explores the local rates of post-operative hypertension and haematoma formation following neck dissection for head and neck cancer. We present this article in accordance with the STROBE reporting checklist (available at https://www.theajo.com/article/view/10.21037/ajo-22-40/rc).

Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Sydney Local Health District Human Research Ethics Committee (2019/ETH07164). Because of the retrospective nature of the research, the requirement for informed consent was waived.

This study was a retrospective cohort study of all patients undergoing neck dissection at our institution. There were no exclusion criteria. Our primary outcome was haematoma formation in those with post-operative hypertension compared to those without. Our secondary outcome was haematoma formation in those with pre-existing hypertension.

For each patient data was collected on demographics, anthropomorphic measurements, pre-existing hypertension and associated medications, the pre-operative blood

pressure and the surgical procedure undertaken. Post-operatively, blood pressures were recorded on admission to post-anaesthesia care unit (PACU) or intensive care unit (ICU), the highest blood pressure in PACU or within the first hour of admission to ICU, and the highest value recorded over the first 24 hours post-operatively. Data was also collected on whether there was a surgical review for haematoma (defined as a recorded diagnosis of haematoma by the treating surgeon in the patient notes) and whether there was return to theatre within the first 24 hours and the indication for return to theatre. All data was collected from patient notes immediately after discharge from hospital, the length of follow-up for our study was for the duration of admission to hospital.

Diagnosed hypertension was defined as any instance where hypertension was recorded as a comorbidity on the pre-anaesthetic assessment or anaesthetic chart. Post-operative hypertension was defined as a SBP greater than 180 mmHg [the American Heart Association (AHA) definition of a hypertensive crisis (20) and the threshold that triggers a clinical review in our institution] at any time during the first 24 hours post-operatively.

Statistical analysis

Data was analysed using R statistical software. Risk ratios were performed and Fisher's exact test was used to determine significance. A two-sided mid-P value of less than 0.05 was deemed statistically significant. When comparing age between groups, a Student's *t*-test was used with a two-sided P value of less than 0.05 being significant. As this was an exploratory analysis not previously undertaken in this population, we did not perform a sample size analysis prior to commencing the study.

Results

One hundred and twenty-seven patients underwent neck dissection at our institution between August 2021 and April 2022. The average age was 64.9 years and 72.4% were male. A proportion of 51.2% of patients had pre-existing hypertension and the mean body mass index (BMI) was 26.89 kg/m^2 (range, 16 to 52.7 kg/m^2). A proportion of 90.6% of neck dissections were a primary dissection and 81.1% were unilateral (*Table 1*). There was no missing data for our specified outcomes.

Eight out of 127 (6.3%) patients had a haematoma

Table 1 Demographic data from the study cohort

Variables	Values, n (%)
Sex	
Male	92 (72.4)
Female	35 (27.6)
Age (years)	
<40	13 (10.2)
40–49	4 (3.1)
50–59	18 (14.2)
60–69	35 (27.6)
70–79	38 (29.9)
≥80	19 (15.0)
Hypertension as a diagnosed comorbidity	
Yes	65 (51.2)
No	62 (48.8)
Anaesthetic type	
TIVA	107 (84.3)
Combined inhalation and intravenous	20 (15.7)
Intravenous anaesthetic agents	
Propofol alone	1 (0.8)
Propofol and remifentanil	118 (92.9)
Propofol, remifentanil and dexmedetomidine	6 (4.7)
No intravenous anaesthetic agent	2 (1.6)
Side	
Unilateral	103 (81.1)
Bilateral	24 (18.9)
Primary or revision	
Primary	115 (90.6)
Revision	12 (9.4)
Antihypertensive taken on day of surgery	
Yes	32 (54.2% of those on regular antihypertensives)
No	27 (45.8% of those on regular antihypertensives)
Not on regular antihypertensives	68

TIVA, total intravenous anaesthesia.

Table 2 Between group comparisons, RR (95% CI) and mid-P values

Variables	Haematoma	No haematoma	RR	
			95% CI	Mid-P values
Post-operative hypertension, n			0.92 (0.12–7.05)	0.985
Yes	1	16		
No	7	103		
Pre-operative hypertension, n			6.67 (0.85–52.71)	0.0397
Yes	7	58		
No	1	61		
Age (years), mean	72.88	64.29	–	0.141 (*t*-test)
Sex, n			2.67 (0.34–20.87)	0.368
Female	1	34		
Male	7	85		
Overweight (BMI >25 kg/m^2), n			0.61 (0.16–2.32)	0.486
Yes	4	75		
No	4	44		
Sides, n			1.63 (0.21–12.64)	0.709
Unilateral	7	96		
Bilateral	1	23		
Primary or revision, n			0.73 (0.10–5.45)	0.725
Primary	7	108		
Revision	1	11		
Dexmedetomidine, n			0 (NA)	0.671
Yes	0	6		
No	8	113		

RR, risk ratio; CI, confidence interval; BMI, body mass index; NA, not available.

requiring evacuation in theatre. Seventeen patients had hypertension (SBP >180 mmHg) in the 24 hours post-operatively. However, there was only a weak association between those experience post-operative hypertension and those patients who had a pre-existing diagnosis of hypertension (phi-coefficient 0.11). The risk of haematoma formation in patients with post-operative hypertension was 0.92 which was non-significant [95% confidence interval (CI): 0.12 to 7.05, P=0.985; *Table 2*]. The risk of haematoma formation was significantly increased in those with pre-operative hypertension at 6.67 (95% CI: 0.85 to 52.71, P=0.0397; *Table 2*). Age, sex or being overweight did not convey increased risk of haematoma formation.

Discussion

Our study was a comprehensive retrospective analysis of all neck dissection at our institution over an eight-month period. We did not find a significant difference in the incidence of haematoma formation between those patients with post-operative hypertension and those without. The rate of haematoma at our institution was similar to that reported by Campbell *et al.* (1). Our study also demonstrates that pre-existing hypertension is a risk factor for haematoma formation, which has also been identified as risk factor in the thyroidectomy cohort.

The limitations of our study are that it is a single-centre trial and that it was underpowered detect small

reductions in incidence of haematomas as they are a relatively rare complication. Any future studies examining this area would need at least 1,000 participants to detect a 50% risk reduction in incidence. A possible confounder was the peri-procedural use of aspirin or anticoagulants. Unfortunately, accurate data could not be obtained regarding periprocedural cessation or continuation of these agents which is a limitation of our study.

Within our cohort, all in the future, we plan to perform a study examining whether the perioperative use of dexmedetomidine can reduce the incidence of haematoma. Possible mechanisms include its anti-inflammatory properties and its direct and indirect effects on the vasculature. It is known that dexmedetomidine can stabilise haemodynamic both intra-operatively and into the post-operative period (21). It is also been shown to decrease intra-operative bleeding in nasal surgery and decrease post-operative pain (22). It is for these reasons that dexmedetomidine is an attractive agent for preventing haematoma as it is in the authors' experience that haematomas can often arise when the patient has significant coughing or poorly controlled pain.

Conclusions

Our study did not find an association between the hypertensive events in the immediate post-operative period and the occurrence of haematomas. Our institution treats an older and frailer cohort with most of the neck dissections being performed for squamous cell cancers of the head and neck and relatively fewer thyroid cancers. This limits the generalisability of our research to other centres but raises questions about whether strict blood pressure control is ideal of even necessary following neck dissection. With haematoma being a rare but potentially catastrophic complication of neck dissection, further research is warranted on identifying and managing other causative factors, particularly the ideal management of patients with a diagnosis of chronic hypertension.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://www.theajo.com/article/view/10.21037/ajo-22-40/rc

Data Sharing Statement: Available at https://www.theajo.com/article/view/10.21037/ajo-22-40/dss

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by Sydney Local Health District Human Research Ethics Committee (SLHD HREC) (2019/ETH07164). Because of the retrospective nature of the research, the requirement for informed consent was waived.

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